Indicator: Quantity of Municipal Solid Waste Generated and Managed (068, 071)

Municipal solid waste (also called trash or garbage) is defined at the national level as wastes consisting of everyday items such as product packaging, grass clippings, furniture, clothing, bottles and cans, food scraps, newspapers, appliances, consumer electronics, and batteries. These wastes come from homes, institutions such as prisons and schools, and commercial sources such as restaurants and small businesses. Municipal solid waste (MSW) does not include municipal wastewater treatment sludges, industrial process wastes, automobile bodies, combustion ash, or construction and demolition debris. Once generated, MSW must be collected and managed, including recovery for recycling (including composting), combustion, and landfill disposal. Facilities that manage MSW also generate residues, such as broken glass, wet papers, ash, that are usually sent to landfills.

Prior to the 1970s, municipal waste disposal usually meant dumping in open landfills where open burning to reduce volume was a common practice. Historically, landfills have been associated with environmental problems such as ground-water contamination, air emissions such as greenhouse gases, land contamination, and increases in vector populations (including rodents, flies, mosquitoes). Most wastes generated in the United States are still disposed of in landfills, but today, MSW landfills are subject to federal or state requirements to minimize environmental impacts. Municipal solid waste landfills are discrete areas of land or an excavation that receive trash or garbage. MSW landfills also receive various other types of wastes such as non-hazardous sludges, hazardous wastes from small quantity generators, household hazardous wastes, non-hazardous industrial wastes, municipal wastewater treatment sludges, and construction and demolition debris.

This indicator shows trends in the national generation and management of MSW on an annual basis starting from 1960, using a materials flow methodology, based on data for source reduction, recycling, land disposal, and combustion practices EPA 2003). The data for MSW are estimates compiled annually by a national journal through a survey to all state officials. No federal agency specifically compiles information nationally on MSW landfills. Landfills that pose threats to human health and the environment are considered to be contaminated lands subject to federal or state cleanup efforts and are not included in this indicator. MSWs also do not land application units, surface impoundments, injection wells, or waste piles.

What the Data Show

The quantity of municipal solid waste generated grew steadily from 88 million tons (MT) in 1960 to over 225 MT in 2001, an increase of 256% (Figure 068-1). During this time, the U.S. population grew by 58%. Therefore, on a per capita basis, MSW generation increased from 2.7 pound per person per day in 1960 to 4.5 pounds per person per day in 1990, where it has thus far stabilized to about 4.4 pounds per person per day in 2001.

In the 1960s and early 1970s a large percentage of MSW was burned, with little recovery for recycling (Figure 068-2). Of the 88 MT of MSW generated, 6% was recovered through recycling and composting, 31% was combusted, and 63% was landfilled. Landfill disposal at that time typically consisted of open dumping, where open burning often occurred to reduce the volume of waste. Through the mid-1980s, quantities sent to incinerators declined and landfills became difficult to site, while waste generation continued to increase. With material recovery rates increasing very slowly during this time period, the burden on the nation's landfills grew dramatically.

MSW quantities sent to landfills or other disposal apparently peaked in the mid-1980s and then began to decline as recycling and combustion increased. Since 1999, the percent going to landfills has declined slightly and recycling has risen slightly. After rising to about 132 MT in 1999, the quantity of MSW sent

to landfills declined to 128 MT in 2001, which is close to 1998 levels. Much of this is attributed to a temporary decline in production of paper and paperboard (a large component of MSW) between 2000 and 2001. In 2001, of the 229 MT generated, 30% was recycled, 15% was combusted, and 56% was landfilled. Over the last several years, the quantity sent to combustion has held steady at roughly 15% of generation.

The number of MSW landfills has decreased substantially in recent years, from nearly 8,000 in 1988 to 1,858 in 2001 (Fig 068-3), while the average landfill size has increased, so more waste-hauling vehicles go to fewer locations and more site maintenance vehicles are required per location. The Southeast has the largest number of landfills with 738; the West and Midwest have 536 and 441, respectively; and the Northeast has the fewest at 143. Alaska has 275 and Hawaii has 9.

At the national level, MSW capacity is not a problem, although regional dislocation sometimes occurs. Compared to 2 years ago, more states have less than a decade of capacity left. Twenty-nine states have more than 10 years of capacity left, down from 1997, when 42 states had more than 10 years of capacity left**.** Six states have 5 to 10 years of capacity remaining. Only three states reported having less than 5 years of capacity remaining. Ten states do not have capacity data available.

Indicator Limitations

- MSW data do not include construction and demolition debris, municipal wastewater treatment sludge, automobile bodies, combustion ash, and non-hazardous industrial wastes that may go to a municipal waste landfill (data are available for construction and demolition debris and some other areas, but year-by-year data are not available)
- Residues associated with other items in MSW (usually containers) are not accounted for in the data.
- The data (including generation, recycling, and recovery data) are generated using the materials flow method, based on national data sources such as trade associations and the Department of Commerce; they are believed to be accurate at a national level, but cannot readily be used at the state and local level.
- Landfill data do not indicate the capacity or volume of landfills, so the fact that there are fewer landfills does not mean that less land is used for managing MSW. Land used for recycling facilities and waste transfer stations also are not included in this indicator.
- The data also do not indicate the status or effectiveness of landfill management or the extent to which contamination of nearby lands does or does not occur.

Data Sources

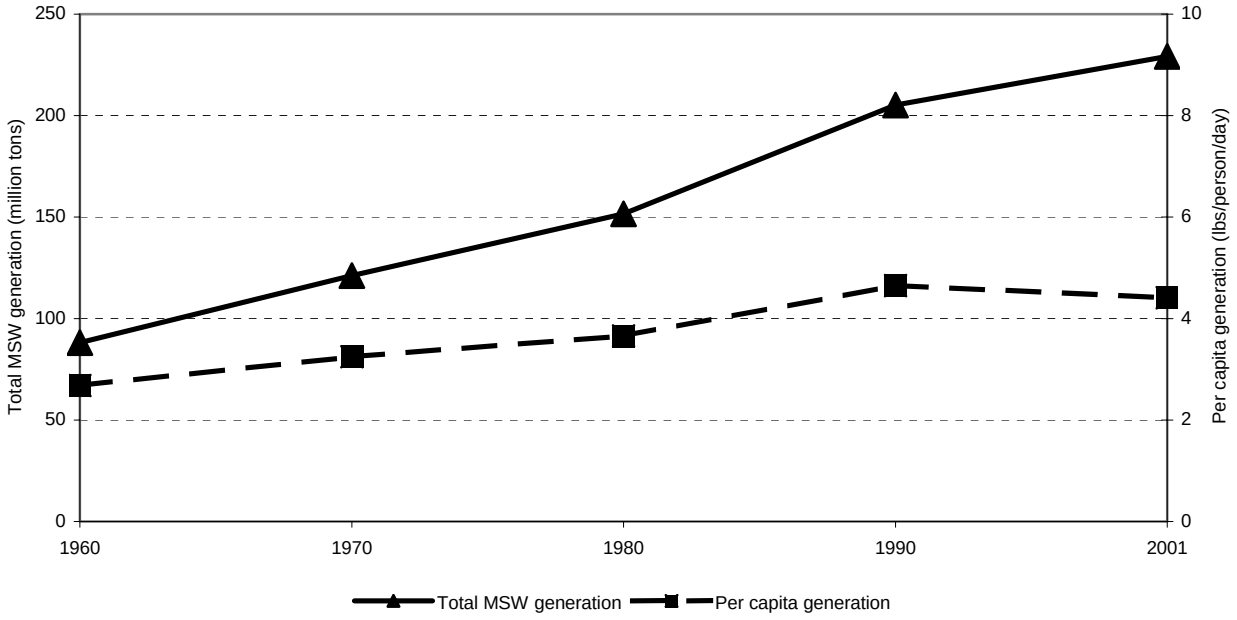
U.S. Environmental Protection Agency. *Municipal Solid Waste in the United States: 2001 Facts and Figures*, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003. (http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm).

References

U.S. Environmental Protection Agency. *Municipal Solid Waste in the United States: 2001 Facts and Figures*, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003.

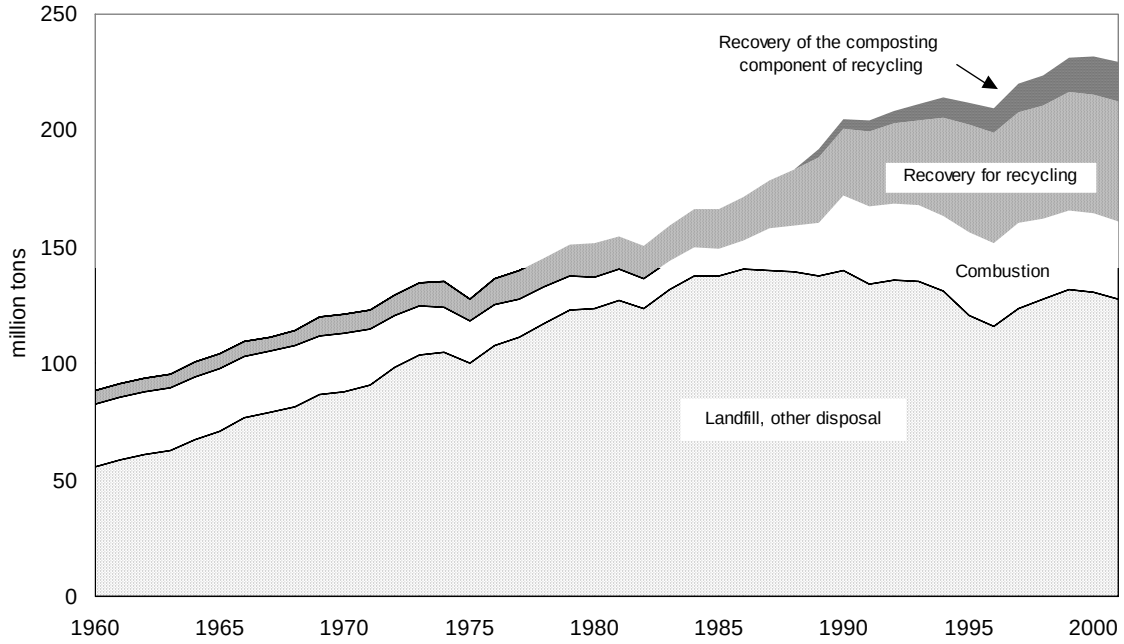
Graphics

Figure 068-1: MSW Generation Rates from 1960 to 2001



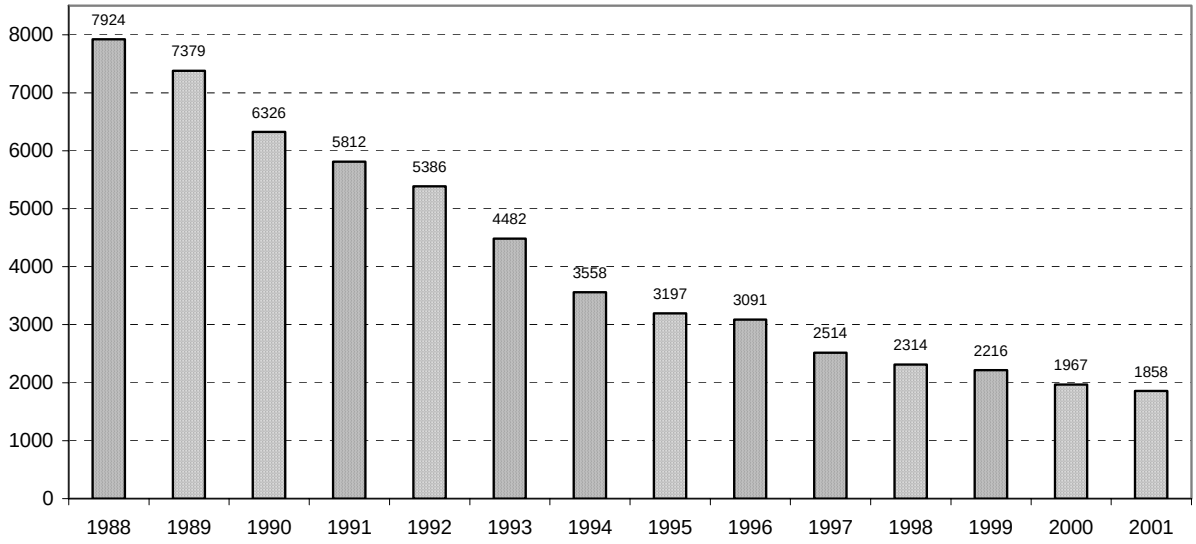
Source: Municipal Solid Waste in the United States: 2001 Facts and Figures, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003.

Figure 068-2. Municipal solid waste management, 1960 to 2001



Source: Municipal Solid Waste in the United States: 2001 Facts and Figures, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003.

Figure 068-3: Number of Landfills in the U.S.



Source: Municipal Solid Waste in the United States: 2001 Facts and Figures, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003.

R.O.E. Indicator QA/QC

Data Set Name: QUANTITY OF MUNICIPAL SOLID WASTE GENERATED AND MANAGED
Indicator Number: 068 (89132)
Data Set Source: Municipal Solid Waste in the United States: 2001 Facts and Figures
Data Collection Date: regular: 1960 - 2001
Data Collection Frequency: 1 yr.
Data Set Description: Quantity of Municipal Solid Waste Generated and Managed (combine indicators 068, 071, 222)
Primary ROE Question: What are the trends in wastes and their effects on human health and the environment?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

The materials flow methodology is based on production data (by weight) for the materials and products in the waste stream. To estimate generation data, specific adjustments are made to the production data by each material and product category. Adjustments are made for imports and exports and for diversions from MSW (e.g., for building materials made of plastic and paperboard that become construction and demolition debris.) Adjustments are also made for the lifetimes of products. Finally, food wastes and yard trimmings and a small amount of miscellaneous inorganic wastes are accounted for by compiling data from a variety of waste sampling studies. More detail can be found in Municipal Solid Waste in the United States: 2001 Facts and Figures, pp22-26. http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Yes, Landfill data are collected by Chartwell through an annual survey to state officials. Chartwell Directory and Atlas of Solid Waste Disposal Facilities 2003, available at http://www.wasteinfo.com. Secondary source is BioCycle Journal of Composting and Organics Recycling 42 (12), December 2001 as reprinted in the U.S. Environmental Protection Agency s Municipal Solid Waste in the United States: 2001 Facts and Figures, EPA530-R-03-011. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, October 2003. (http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm).

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

The materials flow methodology first step is to estimate the generation of the materials and products in MSS. Data on domestic production of materials and products were compiled using published data series. U.S. Department of Commerce sources were used where available, but in several instances more detailed information on production of goods by end use is available from trade associations. Domestic production numbers are adjusted for converting or fabrication scrap generation in the production processes. Examples of these kinds of scraps would be clippings from plants that make boxes from paperboard, glass scrap generated in a glass bottle plant etc. This scrap typically has high value because it is clean and readily identifiable, and it is almost always recovered and recycled within the industry that generated it. Thus, converting/fabrication scrap is not counted as part of the postconsumer recovery of waste. In some instances, imports

and exports of products are a significant part of MSW, and adjustments are made to account for this. Various adjustments are made to account for diversions from MSW. Some consumer products are permanently diverted from MSW because of the way they are used. For example, some paperboard is used in building materials, which are not counted as MSW. Another example is toilet tissue, which is disposed in sewer systems rather than becoming MSW. In other instances, products are temporarily diverted from MSW. For example, textiles reused as rags are assumed to enter MSW the same year the textiles are initially discarded. Some products (e.g., newspapers and packaging) normally have a very short lifetime; these products are assumed to be discarded in the same year they are produced. In other instances (e.g., furniture and appliances), products have relatively long lifetimes. Data on average product lifetimes are used to adjust the data series to account for this. Data on recovery of materials and products for recycling are compiled using industry data adjusted, where appropriate, with U.S. Dept. of Commerce import/export data. Recovery estimates of yard trimmings for composting are developed from data provided by state officials. Mathematically, discards equal that portion of generation remaining after recovery for recycling and composting. More detail can be found in Municipal Solid Waste in the United States: 2001 Facts and Figures, Appendix A. http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

Landfill data cover approximately 80% of the states.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

Not applicable.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

Not applicable.

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

See Municipal Solid Waste in the United States: 2001 Facts and Figures, Appendix A. http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm.

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

A single data source does not exist. Data used have come from numerous sources that are available to the public. These sources are cited in the references sections of the MSW report. See Municipal Solid Waste in the United States: 2001 Facts and Figures. http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

The description of the study is clear and complete. The study method is highly consistent over time. The data base and resulting facts and figures are developed from a wide variety of publicly

available sources, such as trade associations and Department of Commerce data, and best professional judgement. Because of the complexity, the study would not be readily reproducible by a third party. See Municipal Solid Waste in the United States: 2001 Facts and Figures, Appendix A. http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

Data are considered to be of good quality. However, most of the data are from public sources for which the quality assurance and controls processes are not under the direct control of EPA.

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Quantity data are aggregated from key data sources such as trade associations, although government sources such as the Department of Commerce are used where possible. In some instances, data are supplemented with calculations using certain assumptions.

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

No.

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

No.

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

The data do not include non-hazardous industrial wastes, construction and demolition debris, municipal waste water treatment sludge, automobile bodies, and combustion ash that may be sent to municipal solid waste landfills. Some of those wastes (in particular construction and demolition debris) are counted by some states as MSW. In many states, some of these materials, such as construction and demolition debris are disposed along to municipal landfills with MSW. The landfill data do not indicate the capacity or volume of landfills, or in general, a means to estimate extent of lands used for MSW management. For example, the fact that there are fewer landfills does not mean that less land is used for managing wastes because newer landfills are typically larger than their predecessors. The information is also limited by the fact that other lands are also used for waste management, such as for recycling facilities and waste transfer stations, but are not included in the indicator data. The data also do not reflect upon the status or effectiveness of landfill management or the extent to which contamination of nearby lands does or does not occur.